

REMARKS

The above-identified patent application has been reviewed in light of the final Office Action dated March 29, 2004. Claims 1, 9, 13 and 14 have been amended, without intending to abandon or to dedicate to the public any patentable subject matter. No claims have been canceled. Accordingly, Claims 1-20 are now pending. As set out more fully below, reconsideration and withdrawal of the objections to and rejections of the claims are respectfully requested.

Claims 1, 13 and 14 stand rejected under 35 U.S.C. § 112, first paragraph, on the grounds that the specification does not reasonably provide enablement for “avoiding writing at least substantially all previously stored user data and/or parity to said at least two storage devices that was present before the failure” or “writing at least substantially all previously stored user data and/or parity that was previously written to said array of storage devices is avoided.” In the amendments set forth herein, Claims 1, 13 and 14 have been amended to delete use of these phrases. Therefore, the rejections under Section 112 should be reconsidered and withdrawn.

Claims 1-8, 10-12, 14, and 16-19 stand rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,243,827 B1 to Renner, Jr. in view of U.S. Patent No. 5,974,544 to Jeffries; Claim 13 stands rejected under 35 U.S.C. § 103 as being unpatentable over Renner in view of Jeffries and further in view of U.S. Patent No. 5,479,653 to Jones; and Claim 9 stands rejected under 35 U.S.C. § 103 as being unpatentable over Renner in view of Jeffries and further in view of U.S. Patent No. 6,353,895 to Stephenson. In order to establish a *prima facie* case of obviousness under Section 103, there must be some suggestion or motivation to modify the reference or to combine the reference teachings, there must be a reasonable expectation of

success, and the prior art reference or references must teach or suggest all of the claim limitations. (MPEP § 2143). However, each and every element of the claims cannot be found in the cited references. Therefore, reconsideration and withdrawal of the rejections of Claims 1-14 and 16-19 as obvious are respectfully requested.

The present invention is directed to reusing an array of storage devices after certain failures without relying on unwanted and unnecessary procedures related to writing previously stored data, such as restoration or reconstruction processes. Fundamentally, the same storage devices that were used before the failure are used after the failure, including providing an indication that these same storage devices are accessible after the failure has occurred. Furthermore, as generally set forth in independent Claims 1 and 14, updating is performed in response to detecting or receiving an indication of a failure, and without restarting or otherwise interrupting power to the array. The prior art references do not disclose these features.

The Renner Jr. patent is generally directed to multiple channel failure detection in RAID systems, and describes procedures for handling data when there are one or more invalid regions on one or more disks of an array. Physically or logically invalid regions of disks are identified, and the addresses and links of each invalid region are written to a bad region table. The bad region table is provided on disks of the array. The rewriting of metadata in response to detecting a failure to allow access to a previously failed drive, without interrupting power to the array, is not described by Renner. Instead, Renner discusses making a record of a bad area of an array that is stored on other disks in the array, so that the bad areas of the array can be easily identified. (Renner, col. 4, lns. 30-47).

The Jeffries patent is generally directed to a method and controller for defect tracking in a redundant array. In particular, Jeffries discusses a process that marks a drive as bad and never attempts to access it again if it determines that the drive has failed completely. (Jeffries, col. 16, lns. 38-40). On power up, the method discussed by Jeffries determines which drives have failed, which drives have failed previously and now seem OK, and whether a drive has been replaced. (Jeffries, col. 16, lns. 49-51). Accordingly, the rewriting of metadata in response to detecting a failure, without interrupting power to the array, is not described by Jeffries.

The Jones patent relates to modifying a RAID configuration when one or more disk drives of an array fail. The array is initially configured for optimum performance. If it is determined that a disk drive has failed, the array is automatically reconfigured to a different RAID configuration (*e.g.* from RAID 1 to RAID 4). Reconfiguring can occur more than once until no redundancy remains. Like the Renner Jr. invention, the Jones apparatus and method relate to handling user data when one or more disk drives, or regions thereof, fail. This is contrary to the present invention in which a storage device is reused after a failure.

The Stephenson reference is generally directed to a RAID architecture with two drive fault tolerance. In particular, Stephenson discusses accomplishing data recovery from a one or two drive failure by using a two-dimensional XOR parity arrangement. However, Stephenson does not discuss updating metadata in response to ascertaining that a failure has occurred, or updating metadata without interrupting power to the storage array.

Referring to Claim 1, it calls for, among other things, ascertaining that a failure has occurred, and using said array of storage devices after said discontinuing. In addition, Claim 1 recites that using the array of storage devices after the discontinuing includes updating the

metadata to remove an indication that none of the failed drives are accessible and to indicate that those drives are accessible. Furthermore, as amended, Claim 1 recites that the updating of the metadata is performed in response to ascertaining that a failure has occurred, and that the updating of the metadata is performed without interrupting power to the array. Support for such amendment can be found in the Specification, for example at p. 12, lns. 5-27, where an embodiment in which a trust array command is automatically generated is described. A disclosure of such features is not made by the Renner or Jeffries patents. In particular, the cited references do not teach, suggest or disclose reusing storage devices after a failure, or rewriting metadata to allow access to such storage devices in response to ascertaining that a failure has occurred and without interrupting power to the array, as recited by Claim 1. Furthermore, such deficiencies in the Renner and Jeffries references are not made up by either the Jones or the Stephenson reference. Accordingly, for at least these reasons, the rejection of Claim 1 should be reconsidered and withdrawn.

Dependent Claims 2-13 recite additional patentable subject matter. For example, Claims 11 and 12 require a trust array command generated by a host in connection with using again the array of storage devices. Claim 2 specifically defines failures that are not storage device failures and which trigger the updating of the metadata. Claims 3 and 4 are directed to making determinations related to the fact that the storage devices did not fail. Claim 5 more specifically defines metadata as being modified to indicate that the storage devices are valid in a primary dead partition map. Relatedly, Claim 6 requires the writing of all zeros in the primary dead partition map in connection with indicating that the storage devices are all valid. Claims 7-9 further define the determination related to the accessibility of the storage devices. Claim 10

recites that the array of storage devices can be reused based on either a user determination or an automatic determination. Claim 13 more particularly defines the avoiding to include restoring and/or reconstructing data and/or parity. In view of these additional patentable elements, Claims 2-13 should be allowed.

Claim 14 is generally directed to a system in which an array of storage devices are reused after use of at least one storage device of the array is discontinued based on a fault. In particular, Claim 14 recites a host that is used in generating a trust array command related to updating metadata, including changing the metadata from indicating that the one or more storage devices is inaccessible to indicating that the one or more storage devices is accessible after a fault and after use of the array was discontinued due to the fault. Furthermore, amended Claim 14 recites that the metadata is changed without restarting the array, and that the trust array command is generated in response to detection of the fault. Neither the Renner nor the Jeffries reference describes such a system. For instance, Renner does not teach, suggest or disclose changing metadata to allow use of a storage device after a fault occurs. In addition, the Jeffries reference does not teach, suggest or disclose changing metadata without restarting the array, or generating a trust array command in response to detecting a fault. Furthermore, the deficiencies of the Renner and Jeffries references are not made up by any other of the cited references. Accordingly, for at least these reasons, the rejection of Claim 14 and the claims dependent therefrom as obvious should be reconsidered and withdrawn.

Claims 16-19 are dependent claims that depend from Claim 14. Each of these recites additional patentable subject matter. Claim 16 requires that the trust array command be generated independently of any reconstruction or restoration of the array. The defined trust array

command is not found in the prior art. Claim 17 requires that the host control discontinuing use of the array and that it receive an input to generate the trust array command. This limitation related to generating the defined trust array command is not found in the prior art. Claim 18 limits the trust array command to one that modifies a dead partition map to indicate that all of the storage devices are valid. No such modification is taught or suggested by the prior art. Claim 19 requires a determination be made before the trust array command is generated. These determinations related to the defined trust array command are lacking in the prior art of record. In light of the further patentable subject matter of these dependent claims, Claims 15-19 should also be held allowable.

Applicant notes that the subject matter of the present application has already been thoroughly searched, and the amendments presented herein recite elements within that subject matter. In particular, the amendments to the claims do not materially change the relevant field of search, and a further search is therefore not required. Accordingly, entry of the amendments presented herein is respectfully requested.

Applicant notes with appreciation the Examiner's indication that Claim 15 would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims. However, it is submitted that in view of the amendments and remarks set forth herein Claim 15 is now in condition for allowance. Accordingly, Applicant respectfully requests that the objection to Claim 15 be reconsidered and withdrawn.

Applicant additionally notes with appreciation the Examiner's indication that Claim 20 is allowed.

The application now appearing to be in form for allowance, early notification of same is respectfully requested. The Examiner is invited to contact the undersigned by telephone if doing so would expedite the resolution of this case.

Respectfully submitted,

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